DRAFT FINAL

ARIMETCO HEAP LEACH AND PROCESS COMPONENTS WORK PLAN

MARCH 12, 2003

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March 14, 2003

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Subject: Response to Comments on the Arimetco Heap Leach and Process Components Work Plan dated August 23, 2002 and submittal of the Draft Final Arimetco Heap Leach and Process Components Work Plan for the Yerington Mine

Dear Art:

Atlantic Richfield Company appreciates this opportunity to respond to the comments provided by the regulatory agencies on November 12, 2002 for the subject document. This response to comments letter is attached to the Draft Final Arimetco Heap Leach and Process Components Work Plan.

NDEP Comments

NDEP General Comments

The proposed sample quantities and locations are inadequate to defensibly characterize the various tailings areas. Sampling should not only characterize these materials for all potential constituents of concern and establish background concentrations of naturally occurring metals in soils, but also vertically delineate the characterized material. The limited sampling proposed will not provide adequate information to allow future decisions regarding vertical migration of fluids. It is inadequate to evaluate potential hazards to human health and the environment, does not establish background concentrations of metals for comparison of analytical results, will not provide adequate information to avoid conflict and thus is not in the best interest of all parties concerned. Please propose a statistically defensible sampling plan of all tailings areas and background soil locations that will satisfy the requirements listed above.

Response to Comment: The attached Draft Final Arimetco Heap Leach and Process Components Work Plan (Work Plan) has been revised to address this comment. Additional sampling locations have been proposed, and sampling of exposed or excavated side slopes has been added to the Work Plan. Sampling of side slopes should provide indication of relative homogeneity or heterogeneity within the heaps. Atlantic Richfield believes that the increased number of samples, including those collected from side slopes, will adequately characterize the Heap Leach Pads.

NDEP Specific Comments

Page 3; Misquoted in the third paragraph. Storm water run off has been seen running into the ponds at the Slot and VLT Leach pads. Also at the Slot 1 pond, Slot 2 pond and VLT pond storm water runoff has been seen running between the primary and secondary liners. The only storm water run off witnessed from the heaps off containment, would be run off from the leach pad access ramps.

Response to Comment: The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to include the observations noted in the comment.

Page 4; Typo end of second sentence SRK Consulting.

Response to Comment: The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to address this comment.

Page 6; It is interesting that the following DQO is in this draft work plan and there is not a similar DQO in the other three work plans submitted recently. "Assessment of ecological and human health risk resulting from historical seepage of heap leach solution to groundwater below the Yerington Mine". This DQO should be a part of the ground water Work Plan and not this particular plan?

Response to Comment: This DQO was included in the Draft Work Plan to acknowledge that heap solutions are currently being managed at the mine site and, as such, may currently pose a threat to human health or the environment. The use of the term "historical" was not properly used in this context and has been deleted from the attached Draft Final Arimetco Heap Leach and Process Components Work Plan.

Page 8; First sentence heap construction ended in 1998 not 1999.

Response to Comment: The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to address this comment.

Page 9; Construction, All ore leached by Arimetco was Oxide ore not Sulfide. Also no Macarthur ore was put on the Phase I/II heap. The phase I/II heap was primarily oxide ore from the Anaconda W3 dump with a small amount of VLT. Macarthur was mined at a later date.

Response to Comment: The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to address this comment.

Page 10; First sentence should be oxide ore from the Anaconda W3 dump. No Macarthur ore.

Response to Comment: The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to address this comment.

Piping and Ancillary Features; The Solution Drain–down reports to either a lined sump to the (south east) not west. Drain-down to the sump is pumped intermittently to the PLS pond (see Appendix D, Photo 1) not photo 5.

Response to Comment: The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to address this comment.

The last sentence in the first paragraph Meteoric water collection from the plant facilities storm water runoff.

Response to Comment: The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to address this comment.

Page 11; Construction, First paragraph second sentence should be oxide ore from the Anaconda W3 dump not sulfide ore. Also in addition to W3 dump material there was some Macarthur ore and VLT material leached on these two heaps.

Response to Comment: The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to address this comment.

Page 12; Physical Description, Third Paragraph should be oxide ore from VLT, Macarthur Pit and possibly some from the Anaconda W3 oxide dump.

Response to Comment: The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to address this comment.

Page 13; Second sentence, It may also report to a depressed Mega pond leak detection sump in the Anaconda Plant Site area

Response to Comment: The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to address this comment.

Page 14; Construction, Second paragraph Material was placed on the Slot heap between 1993 and 1998 not 1996.

Response to Comment: The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to address this comment.

Third paragraph Arimetco constructed all the pad liners, solution ditches and ponds in house with their own employees.

Response to Comment: The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to address this comment.

Page 15; Second paragraph is oxide ore not sulfide.

Response to Comment: The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to address this comment.

Page 16; Construction, First paragraph last sentence The VLT pad does cover portions of the finger evaporation ponds.

Response to Comment: The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to address this comment.

Second paragraph only the last expansion (approximately 196,000 ft.sq.) was constructed by outside contractors. Arimetco personnel did all the rest of the liners on the entire property.

Response to Comment: The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to address this comment.

Page 17; Physical Description, Second paragraph three types of ore were placed on the VLT heap, VLT tailings, run of mine Macarthur ore, and crushed Macarthur ore. Also note that oxide material not sulfide was excavated from the northeast corner phase III heap and placed on the outer slopes of the VLT benches to protect them from wind and /or water erosion.

Response to Comment: The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to address this comment.

Page 18; First sentence evaporators are run off portable generators only. Hooking them to line power was cost prohibitive.

Response to Comment: The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to address this comment.

Existing data shows a VLT pond capacity of 3,700,000 gallons with 2 feet of free board. With no free board 4,400,000 gallons for 40 days. Based on pond monitoring it appears that we would have less than 30 days even without storm water additions.

Response to Comment: The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to address this comment. The following reference indicates a VLT pond design capacity of 5.04 million gallons without freeboard (6.0 million gallons with 2 feet of freeboard) has been added: "Yerington Mine VLT and Slot Leach Pad Expansion, February1993;in Yerington P-IV Slot & VLT Leach Pad Areas, Section 5.0, Arimetco International, Inc.".

Bottom of page the photos referenced are of the EW building only. There are no photos of the solvent extraction tanks. It may be a good idea to include an overall photo of the

Arimetco plant site. It is possible to take a good picture of the facility from the top of the Phase III Leach Pad if needed. Also the multiple-stage tank referenced in the text is actually the solvent extraction tanks not Raffinate storage.

Response to Comment: The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to address this comment. An additional photo of the Arimetco plant solvent extraction tanks has been added.

Figure 4; There is an additional drain down monitoring location in the heap ditch immediately north of the slot 3 pond.

Response to Comment: The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to address this comment.

Figure 5; The discharge point on the 4-inch line is the drain down monitoring location for the Phase III (4X) leach pad.

Response to Comment: The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to address this comment.

Appendix D; It would be helpful to have a separate photo of each leach pad and the overall plant site.

Response to Comment: Figure 2 of the Work Plan provides an aerial view of all heap leach pads and the overall Arimetco Plant site. Each leach pad is shown with topography in Figures 3 and 4, and the Arimetco Plant is shown separately in Figure 5.

EPA Comments

EPA General Comments

Page 4, 3rd paragraph; The background values cited in this report may represent background soil levels, however, it is premature to cite them definitively as background at this time. EPA has also collected a possible background sample, BK-1, with the results included in EPA's "Anaconda, Yerington Mine Site Emergency Response, Assessment Final Report," dated June 30, 2001. EPA can provide this report if needed. Appropriate background levels should be discussed in our Technical Workgroup meetings.

Response to Comment: The data from Shacklette and Boerngen and BK-1 are provided in the attached Draft Final Arimetco Heap Leach and Process Components Work Plan as representative of currently available background soil data.

As mentioned in prior meetings, any known history for the heap leach and process areas should be included. At a minimum, Atlantic Richfield should review Anaconda and NDEP records, and attempt to interview past employees to determine their potential knowledge of historical usage and/or spills.

Response to Comment: The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to reference spill records available at NDEP. These records were obtained from additional file research and interviews with Joe Sawyer of SRK Consulting, who is the site manager for NDEP's fluid management program.

The Quality Assurance and Quality Control sections are incomplete and it is our understanding that Atlantic Richfield will be submitting a comprehensive site-wide Quality Assurance Project Plan (QAPP) in accordance with EPA's guidance documents (EPA will provide these on request or they can be obtained from EPA's website). After review of the QAPP, the agencies will further comment on any supplementary Quality Assurance/Quality Control sections in the specific work plans. Please provide a date for submittal of the QAPP as this must be reviewed and approved prior to initiation of fieldwork.

Response to Comment: The Draft Quality Assurance Project Plan (QAPP) was submitted on December 6, 2002 and a Final Draft QAPP will be submitted in March 2003.

Radionuclide screening and/or analyses should be proposed. At a minimum, all samples should be screened for radionuclides and a percentage of samples should be analyzed in the laboratory.

Response to Comment: Atlantic Richfield is evaluating the monitoring of radionuclides in site soils.

<u>EPA Specific Comments</u>

1) Page 1, Section 1; The text discusses the data summary report, however, if an initial screening of the data indicates that there is a potential risk and that a risk assessment is required, where will this assessment be included?

Response to Comment: If a risk assessment is conducted, it will be included in the Final Permanent Closure Plan (FPCP) as specified by the Closure Scope of Work.

2) Page 3-4 and Table 1; No information is provided on the Phase I, II, and III heap leach pad liners, though they were supposed to be constructed in compliance with Nevada regulations. Do the Nevada State Mining files contain any of this information?

Response to Comment: Available information from file research and interviews at NDEP and at the Yerington Mine on heap liners has been included in the attached Draft Final Arimetco Heap Leach and Process Components Work Plan.

3) Page 5; It is premature to draw conclusions regarding the homogeneity of materials in all areas and limiting the amount of sampling proposed based on this hypothesis. Sufficient sampling should be proposed to confirm this hypothesis. Uniformity must also be established with depth.

Response to Comment: The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to address this comment. Proposed sampling of side slopes has been added to the work plan. Atlantic Richfield believes that the present number of surface samples, along with additional proposed side slope samples, is adequate to characterize the Heap Leach Pads.

4) Page 5 and Appendix A; Note the beryllium levels in the PLS and raffinate in the October 22, 1999 analyses. These data may indicate the source for beryllium sometimes reported in well samples. If so the next question is whether such beryllium is unique to the Arimetco Leaching Operations, or whether it can, and did, also leach from Anaconda tailings. Tailings used by Arimetco and Anaconda should be collected and leached to better evaluate past and present sources for COCs to groundwater.

Response to Comment: Table 2 of the attached Draft Final Arimetco Heap Leach and Process Components Work Plan indicates that the beryllium concentration within previously analyzed heap materials is within the background levels published by Shacklette and Boerngen (1984) and Rose (1979) for this portion of Nevada. Thus, the concentrations of beryllium in soils, surface mine units and groundwater associated with the mine site may be within naturally occurring background levels. Leaching of heap materials has been conducted as part of operations, and does not need to be reproduced as part of site investigations. The Draft Final Tailings Areas and Evaporation Ponds Work Plan addresses the characterization of tailings materials associated with historic mining operations.

5) Page 6, Data Quality Objectives; The discussion regarding exposure scenarios is incomplete. In order to provide a conservative estimate of risk for comparison, the residential exposure pathway is required to be assessed for each area. This also would give an assessment of the risk any trespassers would encounter although every effort is underway to ensure that the Site is inaccessible. After the data is collected, it should be compared to screening values, such as EPA Region IX Preliminary Remediation Goals. At this time, the determination can be made as to the necessity of a risk assessment for a given area. There is also no discussion of the presence or absence of possible ecological receptors in the process area.

Response to Comment: A complete description of exposure scenarios was presented in the Conceptual Site Model (CSM) for the Yerington Mine Site (dated October 14, 2002) that was approved by the regulatory agencies. The CSM flow diagram is provided in the attached Draft Final Arimetco Heap Leach and Process Components Work Plan as Figure 6. The flow diagram provides a complete schematic of exposure scenarios including potential sources, media pathways and receptors, and process for potential transport and exposure.

6) Page 9, Section 2.1; What are these conclusions based on? Were other people contacted?

Response to Comment: The information on construction, land status, physical description, and operation was obtained from records on file at the Yerington Mine administration office, discussions with state contractor personnel working at the mine (Joe Sawyer, a former Arimetco employee; cited as personal communications where appropriate) and NDEP records. Written references are provided at the end of the attached Draft Final Arimetco Heap Leach and Process Components Work Plan. Where appropriate, additional references have been added to clarify information sources.

7) Pages 11, 13, 18, 19; The text repeatedly concludes that "all detected leaks were contained by the secondary liner and were pumped back up to the Heap". It is not clear where the leak detention points are located, or the manner of construction. Investigations should be proposed to determine whether this hypothesis is accurate.

Response to Comment: The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to state that "All detected leaks in the primary liner were directed by the secondary liner to pumps, and pumped back up to the Heap". Locations of leak detection monitoring points are provided in the attached Work Plan.

8) Page 13, Megapond; What is known about the construction and leak detention system for the Megapond? Was it double lined with HDPE with a leachate collection layer containing leak detectors?

Response to Comment: The Megapond was constructed with a primary and secondary liner with leak detection in between the liners.

9) Page 20, 2nd bullet; The text states that "records of leakage are maintained on-site." These should also be included in the workplan, preferably in a table.

Response to Comment: The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to reference spill reports. Spill reports available from mine site and NDEP files are attached to the Work Plan as an Appendix.

10) Page 21; The list provided should also include a bullet for "evaluating whether there is any leakage beneath liners and whether the VLT materials underneath the liners are a continuing source." The former processing plant that was later covered by the "Megapond" must also be included in the investigation.

Response to Comment: The potential for leakage beneath liners is evaluated using results of leak detection monitoring, which continues under the management of Arimetco process fluids at the mine site by NDEP and its contractorsIt is assumed that the "former processing plant" referred to in this comment is the former Acid Plant that was covered by the Phase III South Heap Leach Pad. Site investigations related to the Acid Plant is discussed in detail in the Process Areas Work Plan.

11) Page 23, Material Characteristics; How will the DQO of evaluating the potential for wind blown dust be met?

Response to Comment: The evaluation of grain size of heap materials will support an evaluation of potential fugitive dust emissions from the mine site, in conjunction with the air quality monitoring proposed in the Draft Fugitive Dust Work Plan.

12) Page 23; Using a grain size analysis to estimate field capacity is useful. However, direct measure of what happens to precipitation falling on heap leaches should also be conducted to determine if long term infiltration and leaching will occur.

Response to Comment: Proposed evaluation of heap drain-down rates and development of predictive drain-down curves for each heap will provide an empirical basis to determine long-term heap water balance conditions.

13) Page 24; One pad cannot be used as an indicator "to illustrate the effects of leakage from all solution ponds operated by Arimetco..."

Response to Comment: The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to address this comment.

14) Page 24; Eventually precipitation, evaporation, and possible infiltration will reach an equilibrium. To evaluate these conditions, data from a combination of infiltration measurements and leach characteristics can be used. It does not appear that either is proposed in this workplan.

Response to Comment: The water balance for each heap will be evaluated on the basis of measured drain-down rates in the context of site meteorologic data (i.e., precipitation and evaporation rates) in addition to NDEP detailed fluid management data. The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to address this comment

15) Page 25; Field screening is not appropriate as the sole mechanism to screen samples for additional laboratory analysis. Field screening can be useful to focus an investigation once a contaminant has been verified by laboratory analysis. Please reconsider the sampling proposal. PID instruments do not measure concentrations in ppm. They measure in PID units. Many petroleum hydrocarbons will not generate a volatile measurable by PID. Thus, a PID cannot be used to eliminate materials from consideration.

Response to Comment: The PID instrument would be used to provide positive indication of the presence of volatile organic compounds, resulting in the subsequent collection and laboratory analysis of soils identified by this field screening procedure. The laboratory analyses would provide data for the presence or absence of specific constituents. The attaché Draft Final Work Plan has been modified to indicate that where no indication of organic vapors are indicated by the PID instrument, soil samples would still be collected on the basis of supplemental knowledge and/or field observations. Thus, the PID is not the exclusive means of determining sample locations, but is simply one of the field tools available to assist in collection of samples from the Arimetco plant site within a particular area or excavation.

The Thermo Environmental 580B PID instrument, with integral microprocessor, provides measurements in parts per million (by air volume) of volatile organic vapors (not to be confused with ppm in the soil). It is not, however, compound specific (i.e., it detects all volatilized organic vapors), and so is used only as a qualitative indicator of the presence of organic vapor. However, for volatile organic compounds, Atlantic Richfield maintains that the OVM (organic vapor monitor) or PID is the best choice in terms of initial screening.

The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to clarify proposed field screening methods.

16) Page 26; A litmus paper with a pH range of 0-14 is not a good QA check on a pH meter. pH papers come in various ranges, not just 0-14 pH units.

Response to Comment: Qualitative pH values in the field would be measured with a pH meter, after formulation of a soil paste at a 1:1 volume ratio of distilled water to soil, in accordance with published procedures. Litmus paper would not be used as an accurate check of the meter, simply a qualitative check. Calibration and field buffer solution checks would be used to provide quality assurance. The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to clarify this procedure.

17) Page 26; Text states that the investigation will “delineate vertical or lateral extent”. We agree with this however, the Technical Workgroup should start discussing the appropriate criteria for evaluation.

Response to Comment: Comment noted.

18) Page 33; It appears that Table 5 should be listed instead of Table 2.

Response to Comment: The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to address this comment.

19) Figure 4; It appears from this figure that there are no leak detection points below the secondary liner of the heap leach pads. Thus, it can not be concluded that all leaks through the primary liners were collected and directed to the ponds. Thus, it will be necessary to evaluate conditions below the heap leach pads by either drilling inclined piezometers under the pads or more easily by sampling the groundwater adjacent to the

downgradient sides of the heap leaches. It is assumed that this will be done under the groundwater workplan, but it should be cross referenced in this workplan.

Response to Comment: The Groundwater Conditions Work Plan focuses on an evaluation of the potential for human health or ecological risk from mine-related groundwater observed at the site. The potential for heap leach pad materials and related process components to pose an ecological or human health risk is addressed in the Arimetco Heap Leach and Process Components Work Plan. These two work plans are related in that the heaps are considered potential sources and groundwater is considered a media pathway per the flow diagram presented as Figure 6 of the attached Draft Final Arimetco Heap Leach and Process Components Work Plan.

As stated in the response to EPA comment no.10, the leak detection systems beneath each heap are functional And are currently managed by NDEP's fluid management contractors. However, existing monitor wells (e.g., WW-01, WW-02, WW-04, WW-10, MW-01, MW-04 and MW-05) that were specifically installed to monitor potential groundwater impacts from the heaps and associated process components, or have served to monitor such potential impacts, are located adjacent to or down-gradient of three heap leach pads and are currently used to evaluate groundwater quality in the area of mine-related groundwater (see Groundwater Conditions Work Plan). Therefore, additional soil or groundwater investigations beneath the heaps are unnecessary.

USDI/FWS Comments

<u>USDI/FWS General Comments</u>
Information is needed on the potential uptake of metals and trace elements by vegetation at these sites. Some vegetation may be deeply rooted and may eventually penetrate any cover caps that may be provided on these sites. Vegetation may be consumed by wildlife or cattle, exposing them to the metals and trace elements that are taken up by the plants. Burrowing mammals may experience dermal exposure to the materials (i.e., waste rock, leach heap, or evaporation pond) if they penetrate any caps on these sites. The risks from these types of exposure should be analyzed. Information is needed on the standards and toxicity benchmarks that will be used to evaluate any data that will be collected in relation to this work plan.

Response to Comment: Based on the results of the proposed site investigations, the assessment of human health and ecological risk will be presented in the FPCP, including the appropriate standards.

<u>USDI/FWS Specific Comments</u>
This document indicates that water may be present in unused ponds and sumps. Water may also pond on the surface of heaps. Seasonal drain down of water from heaps may

also occur in relation to precipitation events. These waters should be sampled and analyzed for metals and trace elements and the data used to determine risk to wildlife, including migratory birds. Stagnant drain down water (*see page 32) should also be sampled and analyzed because it may still be accessible to wildlife. Information is needed on the flow paths of water from these sites to determine if it will impact surface waters such as the Walker River.

Response to Comment: Collection of runoff or pond water quality data is not required because closure activities will preclude ponding of surface water and run-off on the heaps. In addition, most of the ponds are being actively managed to try to reduce the volume of heap fluids.

We disagree with the comment in section 1.3 Previous Monitoring and Data Acquisition, Heap Material Geochemistry (page 4) that states "…surface Heap leach materials are suitable for long-term surface exposure, given the background values for the area." The elevated concentrations of copper mercury, and selenium are not consistent with this statement.

Response to Comment: The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been modified to state "…may be suitable…when compared with background concentrations for the area".

Section 3.3 Data Collection and Analysis Procedures, Field Measurements (page 31) indicates that information will be collected on dissolved oxygen and color of the waters that will be sampled. However, no mention is made of these parameters in the following section (Solution Sampling) under number 4 at the bottom of page 32.

Response to Comment: The attached Draft Final Arimetco Heap Leach and Process Components Work Plan has been revised to address this comment.

If you have any questions regarding the revised document or the responses to comments, please contact me at 1-406-563-5211 ext. 430.

Sincerely,

Dave McCarthy
Project Manager

Table of Contents

Section **Page**

Table of Contents -- Continued

List of Figures

List of Tables

List of Appendices

SECTION 1.0
INTRODUCTION

Atlantic Richfield Company has prepared this Draft Final Arimetco Heap Leach and Process Components Work Plan (Work Plan) to conduct field investigations that will support planning for permanent closure of five Heap Leach Pads (Heaps), their associated process components, and the process plant operated by Arimetco Inc. (Arimetco) located within the Yerington Mine Site. Atlantic Richfield recognizes that these surface mine units are owned by Arimetco. As such, implementation of this Work Plan is contingent upon obtaining the legal approvals necessary to access Arimetco's property and conduct the proposed site investigation activities.

This Work Plan is being conducted pursuant to the Closure Scope of Work (SOW; Brown and Caldwell, 2002a), which describes characterization activities such as the "performance of static and kinetic tests, analysis of whole rock geochemistry, and the collection of hydraulic parameters of pad materials". Process components such as ponds, conveyance ditches, tanks, the electrowinning facility, etc. will also be investigated. Results of the proposed site investigation activities presented in this Work Plan will be compiled and presented in a Data Summary Report for the Arimetco Heaps and Process Components.

The remainder of Section 1.0 of this Work Plan describes the location and hydrologic setting of the heaps, previous sampling and analytical results, and the data quality objectives (DQOs) for this Work Plan in more detail. Section 2.0 presents information about the construction and operational history and current status of the heaps. Section 3.0 presents the details of the site investigation activities including proposed sampling locations, sampling protocols, and quality assurance and quality control (QA/QC) objectives pursuant to the Draft Quality Assurance Project Plan (QAPP; Brown and Caldwell, 2002b). Section 3.0 of this Work Plan also presents a task-specific Job Safety Analysis in the context of a more comprehensive Site Health and Safety Plan (SHP; Brown and Caldwell, 2002c). Section 4.0 lists references cited in this Work Plan.

1.1 Location

The Yerington Mine Site is located west and northwest of the town of Yerington in Lyon County, Nevada (Figure 1). The Arimetco heaps and process components are located between the Yerington Pit and the northern margin of the mine site (Figure 2). The heap leach pads consist of five spatially distinct units constructed in four phases. Based on record drawings, engineering plans, and information provided by Joe Sawyer of SRK Consulting (pers. comm., 2002), the four construction phases are briefly described below and shown in Figure 2:

Phase I	Phase I is located immediately north of the Yerington Pit and southeast of the Arimetco Electrowinning Plant Site.
Phase II	Phase II is contiguous with Phase 1, and extends to the north and west of Phase I.
Phase III	Phase III consists of two separate lined Heaps located north of the paved access road (i.e., northwest of the Arimetco Plant Site, and west of the Vat Leach tanks; Figure 2). The South Heap is located south of the 4X Heap.,
Phase IV	Phase IV consists of two separate Heaps. The Slot Heap borders the eastern property boundary northeast of the Yerington Pit, and includes a portion of the W-3 Waste Rock Area that was previously leached by Anaconda (Figure 2). The VLT Heap was constructed of Vat Leach Tailings deposited by Anaconda, and is located near the north end of the mine site, west of the evaporation ponds (Figure 2).

More detailed maps of the Heaps, and of the Arimetco plant site, are provided in Figures 3 through 5.

1.2 Hydrogeologic Setting

The principal source of water in the Yerington area of Mason Valley is the Walker River (Huxel, 1969). The East and West Walker Rivers originate in the Sierra Nevada mountain range and merge south of the mine site, from where the Walker River flows northward through the valley to Walker Gap. From Walker Gap, it turns eastward and then southeastward to Weber Reservoir and ultimately to its terminus at Walker Lake. The Walker River is the primary source of natural recharge to the alluvial groundwater flow system that underlies the mine site, given that recharge from precipitation is very low (the annual average precipitation rate in the area is 5.46 inches per year; Huxel, 1969).

The native ground beneath the Heaps consists of unconsolidated alluvial deposits derived by erosion of the uplifted mountain block of the Singatse Range and alluvial materials deposited by the Walker River. These unconsolidated deposits, collectively called the valley-fill deposits by Huxel (1969), comprise four geologic units: younger alluvium (including the lacustrine deposits of Lake Lahontan), younger fan deposits, older alluvium and older fan deposits. Lake Lahontan lacustrine deposits appear to have been removed and reworked by the Walker River as it meandered back and forth across the valley (Huxel 1969). Huxel estimated that Pleistocene Lake Lahontan in Mason Valley persisted for a relatively short time and was less than 60 feet deep. Groundwater conditions in the area of the Yerington Mine Site are described in more detail in the Final Draft Groundwater Conditions Work Plan, dated February 25, 2003.

The Heaps were constructed with impermeable liners in accordance with the Nevada Administrative Code (NAC), and the ancillary process components were also lined to contain all process fluids. The Heaps and associated ponds were designed to withstand a 24-hour/100-year recurrence storm event and contain the 24-hour/10-year recurrence storm event.

The ponds and ditches associated with the Heaps have exhibited leakage through primary liners into leak detection systems. Anecdotal observations have been made by Joe Sawyer of SRK Consulting (pers. comm., 2002) of stormwater runoff into ponds adjacent to the Slot and VLT Leach Pads and stormwater runoff into the soil layer between the primary and secondary liners of the Slot 1, Slot 2, and VLT ponds.

1.3 Previous Monitoring and Data Acquisition

Existing information for the Arimetco Heaps primarily consists of documentation regarding the construction and operation of the Phase III and IV pads. Little information is available for earlier construction phases. Recent site investigations conducted by the U.S. Environmental Protection Agency (EPA, 2000) and the results of water quality monitoring conducted by Arimetco prior to abandoning the site are available. On-site contractors retained by the Nevada Division of Environmental Protection –

Bureau of Corrective Actions (NDEP) to manage heap fluids have provided information related to current Heap management operations (Joe Sawyer of SRK Consultants). The remainder of Section 1.3 introduces existing information sources and discusses their significance to the site investigation activities proposed in this Work Plan. Spill reports submitted by Arimetco to NDEP are provided in Appendix A.

Construction Testing and QA/QC

Documents describing construction monitoring and materials testing results for a portion of the Phase II Heap , and for the Phase III and IV Heaps were reviewed. Engineering design reports for the Phase III and IV Heaps contain significant operational history information. Design drawings and as-built drawings exist for the Phase I, II, III, and IV Heaps. A brief summary of heap leach site investigation work, liner testing, and heap materials testing results is provided in Table 1.

Heap Material Geochemistry

EPA conducted geochemical analyses on samples of Heap leach material from the Phase I/II contiguous Heap, the Phase III South Heap, and the Phase IV Slot and VLT Heaps. Whole-rock analyses were performed on these samples as part of an initial CERCLA evaluation of the site. This data is presented in Table 2, along with background soils data from Shacklette and Boerngen (1984) and Rose et. al (1979). The background soil sample BK-1 described in EPA (2000) is also presented in Table 2. In general, as seen in Table 2, the analytical results from EPA's soil testing program indicate that surface Heap leach materials may be suitable for long-term surface exposure, when compared to the background values for the area.

During engineering design of the Phase IV (Slot and VLT) Heaps, samples of the proposed leach materials were tested under the NDEP's Meteoric Water Mobility Procedure (MWMP), and subjected to static testing (i.e., acid/base accounting). The results of these tests are provided in Appendix B. The acid-base accounting (ABA) results indicate that W-3 Waste Rock materials and VLT materials had an acid neutralizing potential of 6.9 and 7.5 tons of calcium carbonate per thousand tons of material (i.e., the materials are slightly acid consuming with a positive net acid neutralization potential).

Additionally, the fine-grained sulfide tailings produced by Anaconda's recovery process were tested under the MWMP for use as secondary liner materials for the Heaps. Although the extent of use of the tailings is not well documented, their compacted permeability was found to be on the order of $1x10^{-7}$ to $1x10^{-8}$ cm/s.

Recently, as described in the Final Draft Tailings Areas and Evaporation Ponds Work Plan (Brown and Caldwell, 2002e), six samples of VLT materials were subjected to leaching tests and laboratory analyses, using the Synthetic Precipitation Leaching Procedure (SPLP; SW846 MTD 1312) and EPA Method 200.7 (Inductively Coupled Plasma / Atomic Emission Spectometry), respectively. Analytical results indicated that the sampled materials were not acid generating.

<u>Heap Drain-down Solution Quality</u>

Prior to abandoning the mining operations at the site, Arimetco analyzed Heap drain-down quality under Water Pollution Control Permit (WPCP) NEV88039. The most recent Quarterly Report obtained in review of historical documentation is from the third quarter of 1999, provided as Appendix A. Sampling locations included Phase III 4X, VLT PLS pond, Slot PLS pond, Plant Feed (representative of combined effluent from all Arimetco Heaps), and the Raffinate Pond (representative of mineral-depleted Heap leach solution from all Heaps). The heap leach solution was used to extract metals from the ore placed on the Heaps, resulting in high metals concentrations in the post-extraction (i.e., drain-down) solution.

The Quarterly Report also contains weekly records of leak detection system inspection for all process components operated under the WPCP. These components include the VLT Pad, Slot Pad, Phase I Pad, Phase II Pad, FX Phase III Pad, Megapond, Arimetco Plant Area, and PLS and secondary ponds throughout the fluid management system.

Physical Stability

Arimetco's 1993 Phase IV assessment and engineering report (Arimetco, 1993) includes an evaluation of Heap slope stability, recommended constructed slope angles and benches, and soil strength properties. Because the lithology and grain size distribution of Phase I, II, III and IV-Slot Heap materials appear consistent, the geotechnical character and physical stability of the heaps are assumed to be similar. The Phase IV-VLT Heap material also appears to be relatively homogeneous, and consists of 0.5-inch-minus materials.

1.4 Data Quality Objectives

The Data Quality Objectives (DQOs) for field sampling and analytical activities described in this Work Plan include the collection of appropriate data to support the:

- Assessment of ecological and human health risk from Heap leach materials to possible down-wind and down-gradient receptors;
- Assessment of ecological and human health risk from soils, solutions and constructed materials in the Arimetco Plant area; and
- Development of closure alternatives for the Arimetco Heaps and associated process units at the Yerington Mine Site.

A four-step DQO process was utilized to develop the activities described in this Work Plan. The DQOs will ensure that data of sufficient quality and quantity are collected to meet the project objectives. The four steps include:

- Step 1. State the Problem;
- Step 2. Identify the Decision;
- Step 3. Identify the Inputs to the Decision; and
- Step 4. Define the Boundaries of the Study.

The problem statement (Step 1) is as follows: "Heap materials and effluent have the potential to create a risk to human health and the environment, and to potentially degrade groundwater beneath the

Yerington Mine Site".

Step 2 of the DQO process (Identify the Decision) asks the key question that this Work Plan is attempting to address: "What monitoring, sampling and analytical activities for the Arimetco Heaps and Plant will serve to evaluate the potential for ecological and human health risk, potential degradation of groundwater, and support closure of the Yerington Mine site?" The field monitoring and sample collection and analysis activities proposed in this Work Plan will be integrated with previous investigations and analytical results to answer this question. The criteria necessary to determine if the proposed Work Plan activities will answer this question include:

- Will the collected data adequately document the potential source characteristics and potential migration pathways of solids and liquids associated with the Arimetco Heaps;
- Will the collected data support an evaluation of environmental pathway processes that could affect the fate and transport of these materials; and
- Will the collected data provide an appropriate baseline to evaluate closure alternatives for the Heaps (e.g. solution containment, reduction, and/or treatment; chemical and physical stability of leached solids).

Step 3 of the DQO process (Identify the Inputs to the Decision) identifies the kind of information that is needed to address the questions posed under Step 2. Relevant historical information includes knowledge of Arimetco Plant operations and components, Heap Leach Pad construction, operations and maintenance, previous field monitoring and analytical results. The site investigation activities proposed under this Work Plan include field observations, field screening, sample collection, and laboratory analysis. These activities will provide data and observations that will serve to evaluate the potential for ecological and human health risk, potential degradation of groundwater, and support closure of the Yerington Mine site.

Step 4 of the DQO process (Define the Boundaries of the Study) defines the spatial and temporal aspects of the field monitoring, sampling and analytical activities proposed in this Work Plan. The field and analytical activities described in this Work Plan are anticipated to be conducted for the five identified Heaps and associated Arimetco process components shown on Figure 2 in 2003.

The DQO steps described above are consistent with the flow diagram presented in the Conceptual Site Model for the Yerington Mine (Brown and Caldwell, 2002d), reproduced as Figure 6 of this Work Plan. The Arimetco Heaps, Process Components and related mine units associated with the Electrowinning Plant are identified as potential sources within the “surface mine units and process areas” category in Figure 6.

SECTION 2.0

BACKGROUND INFORMATION

The Arimetco Heaps shown in Figure 2 were constructed between 1989 and 1998 for the purpose of extracting copper from both newly mined ore from the MacArthur pit located approximately 3 miles north of the Yerington Mine Site, and from waste rock, tailings, and ore previously processed by Anaconda Mining Company from 1953 to 1978. Sufficient copper values remained in the "spent" ore and in materials previously deposited as waste rock to justify re-processing. Arimetco commingled pregnant solution from the various Heaps in the Plant Feed Pond west of the Arimetco Plant Site and, after solution extraction by electro-winning (SX/EW), this solution was treated with sulfuric acid in the Raffinate ponds and then pumped to the various Heaps for re-leaching.

The remainder of Section 2.0 includes a discussion of each Heap and the Arimetco Plant Site organized under the following headings:

- Construction
- Land Status
- Physical Description
- Piping and Ancillary Features
- Operation
- Leak Detection Monitoring

Phase I and II Heaps are contiguous, and have been grouped together for this Work Plan. The Phase III and III-4X Heaps contain similar materials and are adjacent to one and other. For these reasons, these two Heaps are also discussed together. The Phase IV-Slot and VLT Heaps are geographically and materially distinct, and are discussed separately.

2.1 Phase I/II Heaps

Construction

Arimetco personnel constructed the Phase I/II Heaps, and limited records exist for their construction and operation (a summary of their construction and monitoring information is presented in Table 1). Phase I was likely constructed between 1989 and 1990 to leach primarily low-grade oxide ore from the Anaconda W3 dump, with some additional VLT material. The ore material is a low-mica quartz monzonite with some oxide alteration on joint faces. Other replacement minerals (e.g., chlorite) and trace metal sulfides are also present. The material appears to be poorly graded, from 6-inch plus to silt-sized particles.

The Phase I/II Heaps were constructed on a single 40-ml High-Density Polyethylene (HDPE) liner over compacted alluvium and fill materials. A solution ditch surrounding the Phase I area drains to a low point in the northeast corner of the pad, immediately north of a land bridge built between the Phase IV-Slot and Phase I/II Heap Leaches (Figure 3 and Photo 1).

The Phase I Heap originally covered an approximately 6-acre lined area and was built to approximately 100 feet in height. The Phase II Heap expanded west and north from the Phase I pad, eventually covering an additional 8-acre lined area. A variable 2- to 10-foot thick “blanket” of VLT material was placed on the liner surface to act as drain rock, and to protect the liner from the more irregular and angular run-of-mine material to be leached.

Land Status

The Phase I/II Heaps are located entirely on private land (Figure 2).

Physical Description

The contiguous Phase I/II Heaps currently occupy a lined area of approximately 14 acres. The minimum elevation of the top of the heaps is about 4470 feet above mean sea level (amsl) at the north end, near the PLS pond, and the maximum elevation of the Phase I/II Heaps are approximately 4590 feet amsl. The top of the heaps covers an area of approximately 3 acres, and is gently sloping. An east-west lined berm exists near the middle of the contiguous Heap. A "sump" exists at approximately 4472 feet in elevation on the west side of the Heap. This feature was probably a sediment control basin for the original Phase I Heap, but now collects the minor drain-down from the south end of both the Phase I and II Heaps.

Piping and Ancillary Features

A lined berm and solution ditch exists around the entire perimeter of the Phase I/II contiguous Heaps (Figure 3). The ditch is lined with at least one layer of HDPE. Solution drain-down reports to either a lined sump to the southeast, or the PLS pond to the north. Drain-down to the sump is pumped intermittently to the PLS pond (Appendix D, Photo 1). Currently, the PLS pond is generally dry, and all fluids draining to it have evaporated in place. Two raffinate ponds exist northwest of the Phase I/II contiguous Heap (Figure 3). These ponds have historically exhibited significant leakage, and are maintained in a dry condition except for incidental meteoric water collection from the plant facilities stormwater runoff.

Piping related to the Phase I/II Heap Leach includes a line from the west sump to the PLS pond, drain pipes from the Phase II ditch to the PLS pond, and unused leach pipes on the surface and slopes of the Heap (Figure 4). Leach piping may also exist within the Heap. Recent draining of unused pipes reporting to the PLS pond have resulted in temporary standing water.

Operation

Initial leaching of the Phase I/II Heap ended in 1996, but was re-started in early 1997 for approximately five months, with a leaching rate of 400 to 500 gpm. All drain-down not evaporated from the PLS pond was transferred to other Heaps from 1997 until the present (drain-down flow rates are presently too low to accumulate in the PLS pond). Current drain-down is approximately one gpm or less, and has completely ceased during some summer months. (Joe Sawyer, pers. comm., 2002)

Leak Monitoring

Eleven leak detection points exist around the Phase I/II Heap, and in the vicinity of the Arimetco Plant Site (Figure 3). All detected leaks in the primary liner were directed by the secondary liner to pumps, and were pumped back up to the Heap.

2.2 Phase III South Heap and Phase III 4X Heap

Construction

Arimetco personnel constructed both Phase III South and Phase III 4X Heaps, shown in Figure 3. A hydrologic and geotechnical site characterization report (Arimetco, 1990) concluded that the alluvium beneath the Phase III South Heap was built was "…ideal as a sub-base for construction of all necessary facilities." The Phase III South Heap was constructed between 1990 and 1992 to leach low-grade oxide ore from the W-3 Waste Rock Dump, some VLT material and mined material from the MacArthur Pit. The Phase III-4X Heap Leach was constructed between 1992 and 1995 for the same purpose.

Both the South and 4X Phase III Heaps include a secondary liner of compacted, naturally occurring clayey material. Single 40-mil HDPE liners were constructed for solution recovery. The solution drainage ditch surrounding the Phase III South Heap is constructed of a polynet leak detection system over a second 40-mil HDPE membrane. The solution ditch drains to a collection pond in the southeast corner of the pad (Appendix D, Photo 4) and to the Megapond (Appendix D, Photo 5), a large linear lined pond located to the east. Solution from the Phase III-4X Heap solution ditch drains to a low point near the southeast corner of the pad (Figure 3). A variable 2-foot to 10-foot thick "blanket" of VLT material was placed on the liner surface to act as drain rock and to protect the liner from the more irregular and angular run-of-mine material to be leached.

Land Status

The Phase III South Heap is primarily located on private land, and approximately 6 acres of the eastern portion of the pad is located on public land controlled by the BLM (Figure 2). The Phase III-4X Heap

Leach is evenly divided between private and public land, with the public land constituting the central and southwestern portions of the pad. Solution ditches and containment berms are located on public land. Associated pipes, containment features, and ponds for both Heaps are located entirely on private land.

Physical Description

The Phase III South Heap covers approximately 46 acres. The minimum elevation is about 4492 feet amsl at the Megapond. The maximum elevation is approximately 4660 feet amsl along a berm generally along the west top edge of the Heap. A generally flat surface of approximately 15 acres exists at the top of the Heap in two benches (Figure 4). The collection basin termed the "bathtub pond" located to the southeast of the Heap is shallow and has a base elevation of about 4528 feet amsl.

The Phase III-4X Heap covers approximately 50 acres. The minimum elevation is about 4498 feet amsl at a point in the southeastern corner of the pad, from which solution formerly drained to the Megapond. The maximum elevation is approximately 4654 feet amsl. A generally flat surface of approximately 22 acres exists at the top of the Heap in three benches (Figure 4).

The Heap material consists of run-of-mine low-grade oxide ore from the VLT and MacArthur Pit, and possibly from relocated low-grade oxide ore and/or waste rock from the W-3 Waste Rock Dump. The leached ore surface is visually identical to that in the Phase I/II Heaps. The material appears poorly graded, from 12-inch plus to silt-sized particles (Appendix D, Photo 7).

Piping and Ancillary Features

A lined berm and solution ditch exists around the entire perimeter of both Phase III Heaps. The ditches are double HDPE-lined with leak detection polymesh geotextile between the membranes.

Drain-down from the Phase III South Heap reports either to the Plant Feed Pond, from which it may also be re-directed to the VLT by pumping into the 16-inch gravity line, or to the Megapond, from which it is pumped by a barge pump into the 16-inch gravity drain line to the VLT solution ditch (Figure 4). It may also report to a depressed Megapond leak detection sump in the process areas. Solution collected in this sump is intermittently pumped back into the Megapond. Other pipes related to the Phase III Heaps include unused pressure pipes from the Megapond leak sump and unused leach pipes on the surface and slopes of the Heap. Leach piping may also exist within the Heap.

Drain-down from the Phase III-4X Heap reports to the east side of the pad, and is collected by a screened 4-inch pipe (Figure 4 and Appendix D, Photo 9). This pipe drains by gravity alongside the 16-inch gravity line, and reports to the southern corner of the VLT solution ditch.

The collection ponds and drainage ditches have localized folds and leach material embankments that allow standing water to collect. Where standing water occurs, it is generally concentrated by evaporation resulting in the occurrence of sulfate evaporite minerals. EPA sampled this evaporite occurrence, and the laboratory analytical results are included in Appendix C.

<u>Operation</u>

Leaching of the Phase III South Heap ended in early 1997, and re-started for several months in early 1998 at 400 to 500 gpm on the southern portion of the Heap. Current drain-down to both ponds is approximately four gpm or less. Leaching of the Phase III-4X Heap ended in 1999. Solution drain-down rates have decreased from 1,620 gpm during operations to approximately three gpm at the current time.

<u>Leak Monitoring</u>

Nine leak detection points related to the Phase III Heaps exist, as shown in Figure 4. All detected leaks in the primary liner were directed by the secondary liner to pumps, and were pumped back up to the Heap.

2.3 Phase IV Slot Heap

<u>Construction</u>

Construction of the Phase IV Slot Heap is well documented in the Arimetco (1993) Site Assessment, which includes information not available for the previously constructed Heaps. The Slot Heap was initially constructed on a starter pad that had previously been excavated into the W-3 waste rock dump and asphalt-lined area. This waste rock pile is discussed in detail in the companion Waste Rock Work Plan.

The Slot Heap, shown in Figure 3, was expanded to the north by excavating further into the W-3 waste and transporting this material the short distance to the Slot Heap between 1993 and 1998. The pad includes a primary liner of 40-mil HDPE and a secondary liner of compacted naturally occurring gray lean clay. The solution drainage ditch also includes a polynet leak detection system over a second 40-mil HDPE membrane. The solution ditch surrounding the Slot Heap drains to the eastern side, and is routed to one of two PLS ponds either directly or through a sediment control basin.

The Slot Heap covers approximately 86 acres (Figure 3). Arimetco constructed the Slot Heap in 20-foot lifts, along with the pad liners, solution ditches and ponds. A variable 2-foot to 10-foot thick "blanket" of VLT material was placed on the liner surface to act as drain rock and to protect the liner from the more irregular and angular run-of-mine material to be leached. A summary of site investigations, liner testing, and material leach testing information is presented in Table 1.

Land Status

The majority of the Phase IV-Slot Heap is constructed on public land, with a portion of the west and south slopes on private land. Most pipes, containment features, and ponds for the Slot Heap are located on public land (Figure 2). Some solution ditches and containment berms are located on private land.

Physical Description

The minimum elevation of the Slot Heap is about 4400 feet amsl at the outlet to the sediment control basin and PLS ponds. The maximum elevation is approximately 4545 feet amsl along several berms on the east side of the Heap top surface. A generally flat surface of approximately 37 acres exists at the top of the Heap in five benches (Figure 3). The overall slope of the Slot Heap was designed at 2.4H:1V and the average slope, as measured from the two-foot topographic base, appears to be consistent with this design slope.

The Heap material consists of run-of-mine low-grade oxide ore mined from the W-3 Waste Rock Area. The leach material rock is a quartz monzonite with little or no sulfide alteration on joint faces. The material appears poorly graded from 12-inch plus blast rock to silt-sized particles.

<u>Piping and Ancillary Features</u>

A lined berm and solution ditch exists around the entire perimeter of the Slot Heap (Figure 3). The ditch is double HDPE-lined with leak detection polymesh geotextile between the membranes. Drain-down from the Heap reports to one of two PLS ponds on the east side of the pad, from which it was pumped to the surface of the Heap for evaporation via a system of mechanical evaporators ("wobbler" and modified wobbler misters; Appendix D, Photo 12). Various pipes related to the Slot Heap include unused pressure pipes from both PLS ponds, the recently decommissioned evaporation system, leak detection pipes, and unused leach pipes on the surface and slopes of the Heap. Leach piping may also exist within the Heap.

Given recent declining drainage rates, this system has been modified, and solution is currently pumped via a 12-inch HDPE pipeline to the Plant Feed Pond west of the Arimetco Plant Site. Because the northern PLS pond has historically leaked, solution is primarily routed to the southern PLS pond, and the northern pond is pumped dry when necessary (Appendix D, Photo 11). Crystal growths of evaporite minerals exist in both ponds and the solution drainage ditches. The EPA sampled this evaporite, and the results of laboratory analysis are included in Appendix C.

<u>Operation</u>

Arimetco ceased adding make-up water and acid to the Heap in November 1998, and solution was transferred to the VLT Heap fluid management system in 2000. Solution drain-down has decreased from 2,200 gpm during normal operation to the current rate of approximately 34 gpm.

Leak Monitoring

The seven leak detection monitoring points for the Slot Heap are shown in Figure 3. All detected leaks in the primary liner were directed by the secondary liner to pumps, and were pumped back up to the Heap.

2.4 Phase IV VLT Heap

Construction

The VLT Heap covers approximately 54 acres, as shown in Figure 4. The VLT Heap was constructed on the southern portion of the previously operated Finger Evaporation Ponds and alluvium north of the existing VLT Tailings Area. The VLT Heap was extended to the south by excavating into the VLT tailings, and transporting this material to the Heap. Arimetco constructed the VLT Heap, in 20-foot lifts, between 1995 and 1998. Arimetco also constructed the associated pad liners, solution ditches, and ponds. The last expansion of the heap (approximately 196,000 square feet) was conducted by outside contractors. The leach pad includes a primary liner of 40-mil HDPE and a secondary liner of compacted naturally occurring gray lean clay. The solution drainage ditch also includes a polynet leak detection system over a second 40-mil HDPE membrane. The solution ditch surrounding the VLT Heap drains to the northeast corner, and is routed through a large sediment control basin to an adjacent PLS pond (Appendix D, Photo 13).

A stormwater run-on diversion ditch for the 100-year, 24-hour design storm event of 2.6 inches was designed to convey a peak flow rate of 650 cfs, and was to direct run-on to several lined evaporation ponds to the north of the VLT Heap. However, it is not clear from site topography and ground inspection that this diversion was built. A summary of VLT Heap Leach site investigations, liner testing, and material leach testing information is presented in Table 1.

Land Status

The entire VLT Heap and its solution ditches, ponds, and other ancillary features are constructed on private land (Figure 2).

Physical Description

The minimum elevation of the Phase IV-VLT Heap Leach Pad is about 4386 feet amsl at the outlet to the sediment control basin. The maximum elevation is approximately 4514 feet along several berms on the east side of the Heap top surface. A generally flat surface of approximately 29 acres exists at the top of the Heap in two benches (Figure 4). The overall slope of the Heap was designed and constructed at 2.4H:1V.

The Heap material consists of oxide tailings (VLT) and run-of-mine and crushed ore from the MacArthur Pit. The rock is a quartz monzonite with no surface mineralization readily apparent. Other replacement minerals (e.g., chlorite) and trace metal sulfides are also present, as indicated by leach solution and MWMP chemistry. The EPA sampled evaporite minerals similar to those found in other Heaps, and the results of laboratory analysis are included in Appendix C. Visual observation and reviewed documents indicate that the material is a homogeneous, poorly graded 0.5-inch-minus to sand sized crusher product. Oxide ore was excavated from the northeast corner of the Phase III Heap Leach Pad and placed on the slope faces and benches to protect the finer VLT materials from wind and/or water erosion.

Piping and Ancillary Facilities

A lined berm and solution ditch exists around the entire perimeter of the Heap (Figure 4). The ditch is double HDPE-lined with leak detection polymesh geotextile between the membranes. Drain-down (Appendix D, Photo 14) from the Heap reports to a PLS pond at the northeast corner of the pad, from which it is pumped to evaporators on an approximate 3-acre, 1200-foot by 100-foot bench on the southeastern face of the VLT Heap. Various pipes including the active pressure pipe from the PLS pond, piping for the evaporation system, leak detection pipes, and unused leach pipes on the surface and slopes of the Heap (Figure 5). Leach piping may also exist within the Heap.

Drain-down solution is currently delivered to several high-efficiency mist-sprayer evaporators (Appendix D, Photo 15), which are powered by portable generators. Because there is approximately 5.04 million gallons (design) capacity in the single VLT PLS pond, the current cumulative flow of approximately 76 gpm from all Heaps on site results in a storage duration of approximately 46 days (Arimetco, 1993). However, stormwater runoff from the VLT Heap and other facilities, and potential stormwater run-on from the upgradient alluvial fan may temporarily decrease this storage capacity.

Operation

Arimetco ceased adding make-up water and acid to the VLT Heap in November 1998. Solution drain-down has decreased from 3,300 gpm during operation to the current rate of approximately 35 gpm. The mechanical evaporators currently operate on a daily cycle, as needed.

Leak Monitoring

The five leak detection points for the VLT Heap are shown in Figure 4. All detected leaks in the primary liner were directed by the secondary liner to pumps, and were pumped back up to the Heap.

2.5 Arimetco Plant Site

Construction

Arimetco constructed its mineral recovery circuit after acquiring the Yerington Mine in 1989, in conjunction with construction of the Phase I Heap. Limited records and historical description are available for the extraction facility and its components.

Land Status

The entire Electrowinning Plant Site is located on private land (Figure 2).

Physical Description

The Arimetco Plant Site (Figure 5) consists of an Electrowinning building on the north side (Appendix D, Photos 16-17), concrete Solvent Extraction Tanks (Appendix D, Photo 19), offices, laboratory (Appendix D, Photo 18) and a maintenance shop. Two HDPE-lined Raffinate Ponds are located east of these structures.

Piping and Ancillary Facilities

A large number of buried and exposed pipes, valves, monitoring ports, and pumps (all currently unused) exist at the Arimetco Plant Site. Additionally, areas between the buildings are currently filled with refuse. The interior of the SX/EW building, lab, and shop buildings may contain a significant amount of abandoned equipment, chemicals in containers, and other items. An existing inventory of such items is provided as Appendix E.

Operation

Arimetco continued processing solution through the Plant Site until its abandonment of the mine site in January 2000.

Leak Monitoring

Leak monitoring points for the two HDPE-lined Raffinate ponds are shown on Figure 5.

Reported Spills

Spill reports were submitted to NDEP for spills that occurred during Arimetco operations from January 1993 to September 1998 (Appendix A). Six spill reports for the Arimetco Plant or related operations that were on file with NDEP were reviewed, and a records search was conducted at the mine site for documents relating to the spill reports. The following summarizes the information obtained on the spill reports:

Report Date: January 8, 1993.

Reporting person/agency: Rick Haverstrike (Arimetco General Manager).

Description: 8,000 to 12,000 gallons of pregnant leach solution at a concentration of four grams per liter sulfuric acid spilled over the top of a channel "from pregnant pond". The exact pond and channel from it is not stated in the spill report, and no further documentation of the incident was found in records at the mine site. The spill was caused by freezing in the channel and consequent overflow of solution. The "spillage was returned to pond" and the "area cleaned up".

Report Date: February 3, 1997.

Reporting person/agency: Dennis Dalton.

Description: Approximately 50,000 gallons of leach solution at a concentration of four grams per liter sulfuric acid overflowed from Plant Feed Pond that is situated above and to the southwest of the Arimetco Plant. The overflow was caused by "operator error". The spill flowed out and along Burch Road in front of the Arimetco Plant, settling in a low area of the road just northeast of the Anaconda Office building. The total area covered by the spill was approximately three acres, including private and BLM land. The solution that had settled in the low area of Burch Road was pumped back to the pond. Some impacted soil was excavated in certain areas, although documentation was not found detailing the location or volume of excavated soil. Soil samples were collected at seven locations, some up to six feet below ground surface. The low area on Burch Road was treated with lime, and some areas were covered with top soil and seeded. The pond berm was rebuilt by Arimetco. A Finding of Violation (FOV) was issued by NDEP on February 11, 1997.

Report Date: March 31, 1997.

Reporting person/agency: Travis Campwell.

Description: Approximately 73,000 gallons of "acid solution" at a concentration of eight grams per liter acid flowed over a containment berm at the "#4 Leach Pad containment area", as a result of a "pipeline split". The impacted soil was excavated and placed back on the heap leach. No additional information was available from mine site records.

Report Date: February 24, 1998.

Reporting person/agency: Gary Robinson / Arimetco.

Description: Approximately 240,000 gallons of "raffinate" solution was "spilled to sewage ponds as a result of a 12-inch pipeline collapse", according to the spill report. Documentation at the Yerington mine office indicates that the incident occurred just south of the VLT Heap Leach Pad along the 16-inch solution pipeline when the line broke at a weld in the piping. The solution flowed to a low area which was a former sewage lagoon, and accumulated to a depth of approximately one foot above ground surface. The solution was pumped out of the low area to the VLT Leach Pad. There was no record of soil sampling.

Report Date: March 9, 1998.

Reporting person/agency: Gary Robertson / Arimetco.

Description: Approximately 800 to 1,000 gallons of “raffinate” was “release(d) to a dirt road” as a result of a “hose failure”, according to the spill report. Records on file at the Yerington mine office indicate that the incident occurred when a weld on the pipeline broke, releasing solution inside a containment ditch along the road to the VLT Leach Pad near the southeast corner of the leach pad. Most of the solution was contained within the containment ditch, but “some” spilled on to the road, where dikes were built to contain the overflow. The spilled solution was recovered with a front end loader.

Report Date: September 8, 1998.

Reporting person/agency: Nicky Bryon / Lyon County Commissioners Office

Description: The spill report indicates that the reporter noticed a “white film on (the) road” and that “bulldozers (were) moving dirt in the area ”west of the guard shack at the Arimetco Plant. No further description of the incident was provided on the spill report. A former Arimetco employee, working at the plant at the time of the report stated that the “white film” observed was likely dried clay along the road. The clay was being used to rebuild the berm on the north side of the Plant Feed PLS Pond, and the bulldozers observed were being used to move the clay up to the pond.

2.6 Summary of Current Conditions

After filing for bankruptcy in 1998, Arimetco abandoned its operations at the Yerington Mine in January 2000. The leach pads and associated process components contained approximately 90 million gallons of pregnant leach solution. NDEP responded to this situation by assigning resources from the Environmental Response and Mitigation (EMAR) program to conduct fluid management activities at the site in order to prevent a release of Heap solutions. The EMAR subcontractor, SRK Consulting, retained several former Arimetco employees (including Mr. Joe Sawyer as Site Manager) to manage the Heap solutions and maintain the process components at the site. Fluid management and site maintenance currently involves the following activities:

- Several pumps are operated intermittently to direct drain-down effluent or leakage from primary containment to the VLT system for evaporation. Additionally, 3 to 5 mist-sprayer evaporators are operated on the VLT Heap on a daily schedule to reduce solution inventory. Each pump is inspected or turned on and off during each daily shift.
- In addition to active pumping, solution drains by gravity flow from the Phase III-4X solution ditch, and a variety of pipes for existing or historical purposes exist and are visually inspected for leakage or failure.
- Solution drainage rates are measured by several weirs on the mine site, including the Slot, Phase III-4X, and VLT solution ditches. Leak detection systems are monitored, and records of leakage are maintained on-site.
- Site personnel conduct a variety of activities that enhance environmental and safety conditions including the drainage of standing pipes to existing ponds, relocation of transformers and other potentially hazardous features to covered areas, general cleanup, and site security.
- Status of Arimetco Plant cleanup (as of February 21, 2003): Chemicals of all types, including solutions, sludges, and precipitates, are being removed from the plant. Twenty tanker loads of electrolyte solution, 3 tanker loads of kerosene, and 2 tanker loads of precipitated sludge from the extraction tanks have been removed. Each tanker load is approximately 3,500 gallons. Additionally, all solution conveyance pipes are being drained and inspected. All storage drums are being characterized in preparation for removal from the site; there are approximately 500 drums of various contents. In the Electrowinning building, all cathodes have been cleaned, and anodes are presently being cleaned.

SECTION 3.0
WORK PLAN

Atlantic Richfield proposes to conduct site investigations of the Arimetco Heap Leach Pads, related process components and the Arimetco Plant Site pursuant to the SOW, including: “static and kinetic tests, analysis of whole rock geochemistry, and the collection of hydraulic parameters of pad materials”. Process components associated with the leach pads (e.g., ponds, ditches, etc.) and the Arimetco Plant Site (e.g., raffinate ponds and the electro-winning building) will also be investigated. Soils within these process areas, including areas of reported spills, will also be characterized. All site investigations, and related quality assurance/quality control (QA/QC) procedures, will be consistent with the DQOs described in Section 1.4 and the site Quality Assurance Project Plan (QAPP).

As described in Section 2.0, drain-down rates from all the Heaps have declined significantly since operation ceased. The observation that drain-down from the Phase I/II Heaps have declined to less than one gpm, with zero drain-down during summer months, indicates that the current fluid management system is working well to reduce the inventory of solution in the Heaps. Given these empirical data, this Work Plan includes continued monitoring of drain-down rates and effluent water quality as the best method to evaluate the water balance, drain-down predictions, and solution chemistry for each Heap.

This Work Plan provides for the evaluation of the following general characteristics of each Heap, and their associated process components:

- Material Volume
- Material Geotechnical and Geochemical Characteristics
- Solution Volumes, Drain-down Rates and Chemistry
- Process Component Inventory

The geochemistry of Heap materials will be an important factor in the evaluation of closure options because of the potential for heap solutions to degrade groundwater or create an ecological or human health risk. Additionally, the agricultural properties of heap materials, availability of nutrients needed by revegetation or volunteer vegetation, and physical parameters such as grain size, gradation and water retention will determine whether the materials can be used directly as a growth medium, or will require mixing with other materials or covering. The geochemical characteristics of sludge in process ponds and materials in process areas will also require evaluation.

In order to demonstrate the physical stability of the Heaps, relative to final post-closure conditions, material characteristics will have to be evaluated to support slope stability and stormwater management concerns. Grain size information will also assist in evaluating the potential for heap materials to source fugitive dust. Erosion-resistant materials may be required in the post-closure stormwater management design. The physical characteristics of process area components such as the electro-winning plant, building foundations and pond liners will also be evaluated from a closure perspective.

Prior to the start of work, field personnel will conduct a health and safety meeting to review the Site Health and Safety Plan (SHSP) and to verify personal training certification. Copies of training certificates and attendance logs from the meeting will be obtained. All work will be conducted in accordance with the Site Health and Safety Plan, and with the JSA provided in Section 3.4.

3.1 Heap Characterization

The following paragraphs outline specific tasks for characterization of the Heaps and associated process components including material volumes, geotechnical and geochemical characteristics, solution volumes and drain-down field measurement of Heap solutions, and Process Component inventory. Sampling and analytical protocols are discussed in Section 3.3.

<u>Material Volumes</u>

The quantity of material contained in each of the Heaps will be calculated by interpolating adjacent grades to estimate original ground topography, and comparing this surface with a Digital Terrain Model (DTM) based on topography generated by photogrammetric methods and dated August, 2001.

Material Geotechnical and Geochemical Characteristics

Sample locations for geotechnical and geochemical characterization of the heap leach pads are shown on Figures 3 and 4, and the type and number of samples is summarized in Table 4. Surface samples will be collected from the top of the heaps and from the side slopes, to assess the general degree of heterogeneity or homogeneity of each Heap. Samples collected from the Heaps will be submitted to a Nevada-certified laboratory for whole-rock analysis, agricultural analysis, and static acid-base accounting (ABA). Whole–rock analysis analytes are listed in Table 5. Static ABA provides the acid and neutralization potentials, and the net neutralization potential, in terms of mass of calcium carbonate per mass of material.

Samples of heap materials specified for agricultural parameter analyses will be submitted to a laboratory experienced in the evaluation of soils for use as a growth medium. The samples will be tested for the following parameters:

- Nitrogen, Phosphorus, and Potassium (NPK)
- Boron and Chlorine
- Calcium, Magnesium and Sodium
- Sodium Absorption Ratio (SAR)

The capacity of Heap materials to retain moisture will also be evaluated. Samples will be collected for laboratory analysis of grain size distribution (ASTM D-422 testing method). The grain size distribution data will be used to estimate the field capacity, wilting point, and saturated hydraulic conductivity of the Heap materials. Moisture retention capacities (ASTM D-2325 or D-3152) will also be evaluated for Heap material use as a growth medium.

Solution Volumes, Drain-down Rates and Chemistry

The Phase I/II Heap Leach has been observed to dry completely during dry summer periods, and therefore solution currently draining is probably limited to infiltrated meteoric water. Based on the final solution application date of approximately August 1997, it is assumed that this Heap completely drained over a four-year period. Heap leach pads in Nevada have been observed to drain at an exponential or geometric rate (i.e., a decaying rate of decline that asymptotically approaches zero).

Ongoing monitoring by NDEP of solution drain-down rates can be used to establish empirical drain-down curves for each Heap. These curves will be used to estimate the volume of solution that remains in inventory within the Heap and predict the future drainage characteristics of each Heap after mine site closure. These drain-down curves will be illustrated graphically within the Data Summary Report for the Arimetco Heaps. The data will also be compared to an equivalent saturated pore volume based on the estimated porosity of materials within each Heap.

Samples of drain-down solution will be collected from each Heap to evaluate the current chemical characteristics of the solutions. These samples will be submitted to a Nevada-certified laboratory for a modified Profile II analysis for constituents listed in Table 6. Sampling and analytical protocols are described in Section 3.3.

<u>Process Component Inventory</u>

The fluid management components including ponds, pipelines, pumps, leak detection ports, and other features associated with each Heap will be inventoried by observation and interview of site maintenance personnel. Pipe size, length and size and number of pumps will be recorded on a standard Catalog Form, provided in Appendix F. The inventoried process components will be integrated into the closure evaluation for each Arimetco Heap and for the Arimetco Plant Site.

<u>Field Measurements – Heap Solutions</u>

Measurements in the field will consist of flow rates and field parameters of Heap solutions in pipes or Heap leach drainage channels. Flow from pipes will be obtained by filling a container of known volume and recording the time required to fill the container or from flow measurement devices. Flow in drainage channels will be performed by measurement of depth in an installed weir, where available. Flow based on transfer volume from leak detection sumps will be evaluated based on NDEP fluid management records for the most recent fluid transfer event.

Field parameters for solutions will include pH, temperature, electrical conductivity, dissolved oxygen, and color. Field information will be recorded in a field notebook. For each sampling event, the information described in the documentation section, provided below, will be recorded. Prior to sampling, the pH, dissolved oxygen and electrical conductivity probe(s) will be calibrated and the conductivity probe will be checked with a standard. After sampling is completed, a drift check will be performed with each instrument, using the same standard solutions used to calibrate. The purpose of the drift check is to assess the loss of accuracy that often occurs when measurements are performed at different locations. If solution measurements are obtained at a non-specific geographic location (e.g. the weir at the entrance to the settling pond for the VLT Heap Leach) the monitoring and sampling location will be established using a portable GPS receiver.

3.2 Arimetco Plant Site Characterization

The magnitude and extent of potential impacts from material or solution spills will determine the level of effort required to close the Arimetco Plant Site. The field activities described below will provide information necessary to evaluate the magnitude and extent of potential impacts. The activities described in this Section include plant site inventories and field screening. Sampling and analysis protocols are described in Section 3.3.

<u>Arimetco Plant Site Inventory</u>

A Plant Site inspection will be conducted in the company of EMAR personnel to update the existing inventory prepared for NDEP (Appendix E). The inventory will identify structures, stored materials, and areas where spills were reported or where soil is discolored. The physical condition of each component, and amount of unused materials or disposed waste will be noted. Equipment and fixtures located within the buildings will be catalogued, with particular attention to valves, sumps, containers, or tanks which may contain chemicals or process solution. The Plant site will be mapped using large-scale aerial photographs and other detailed topographic base maps to identify buildings, solution management features, extent of disposed material or equipment, and the size of buildings or other features.

Field Screening – Plant Site Soils

The proposed field screening and potential sampling locations of representative soils in the Arimetco Plant Site area are shown in Figure 6, and listed in Table 4. Field screening will be conducted using calibrated pH meter and Photo Ionization Detection (PID) instruments to collect field data on soils collected with a backhoe, hand auger or shovel at depths up to 12 inches below ground surface. The screening event will identify exposed and sub-surface soils with concentrations of organic vapors (i.e., potential petroleum impact) that exceed 20 parts per million by volume (ppm-v) and/or with pH values less than 5.5. If, at any location, organic vapor is detected above 20 ppm-v and/or pH values are less than 5.5 standard units, a composite soil sample will be collected for laboratory analyses at that location from the 6- to 12-inch interval below ground surface (bgs).

The PID instrument would be used to provide positive indication of the presence of volatile organic compounds, resulting in the subsequent collection and laboratory analysis of soils identified by this field screening procedure. The laboratory analyses would provide data for the presence or absence of specific constituents. Where no indication of organic vapors are indicated by the PID instrument, soil samples would still be collected if supplemental knowledge and/or field observations indicate that spills had occurred at or in close proximity to a particular sample location. Thus, the PID is not the exclusive means of determining sample locations, but is simply one of the field tools available to assist in collection of samples within a particular area or excavation.

For pH field screening, a solution will be created in the field with soil and de-ionized water, and pH readings will be performed with a calibrated field pH meter. Five grams of soil will be collected from a field screening location and weighed into a four-ounce glass jar, on an electronic digital scale, to the nearest 0.1-gram. A five-milliliter aliquot of de-ionized water will be measured in a graduated cylinder, and added to the five grams of soil. The jar will be sealed with a teflon-lined lid, and shaken vigorously. After 30 minutes of allowing the jar to sit undisturbed, the jar will be shaken again. The lid will be removed and the pH instrument probe inserted into the soil/water solution. After the pH instrument readout stabilizes, the pH measurement will be recorded in a field notebook. At one of ten sample locations, the prepared soil/water solution will be checked with pH litmus paper (0 to 14 pH units) to provide reasonable quality assurance of the instrument readouts. The pH instrument will also be checked for drift at a minimum of every 10 samples by placing the instrument probe in standard buffer solutions. Any instrument drift will be noted in the field notebook, and the instrument will be re-calibrated.

For organic vapor measurements, portions of each field screening sample will be placed in a sealed plastic bag and allowed to sit in direct sunlight or other heat source to generate vapor. Organic vapor concentrations will then be measured with a portable organic vapor monitor (OVM) equipped with a PID by inserting the OVM inlet into the plastic bag and recording the maximum vapor reading in ppm-v.

Based on the field screening, composite samples collected for laboratory analysis for soils potentially impacted by acidic solutions or petroleum hydrocarbons would be subjected to the following procedures:

- Total petroleum hydrocarbons (extractable TPH-E or purgeable TPH-P) for locations with organic vapor concentrations that exceed 20 ppm-v or on the basis of field observations.
- Laboratory pH and acid-base accounting (ABA) for locations with soil pH values less than 5.5.
- Whole-rock geochemistry for selected locations with soil pH values less than 5.5.

Field screening results would be used to determine whether any additional excavation and sampling activities beyond the 0-to-12 inch sub-surface interval were necessary to delineate the vertical or lateral extent of impacted soils at a particular location. At each location, if the soil pH value is measured at less than 5.5 and/or organic vapors are detected to be greater than 20 ppm-v, an additional screening would be conducted at three feet bgs. This procedure would continue at depths of six feet, ten feet, and every five-foot depth after ten feet bgs until the maximum depth of the excavation equipment is reached. A confirmatory composite soil sample would then be collected at the appropriate depth from the soil (alluvial) depth determined to be unaffected by acidic solutions or hydrocarbons. Samples determined to be impacted by these field screening procedures would then be submitted for one or more of the laboratory analyses listed above.

3.3 Sample Collection and Analysis

The following paragraphs outline specific procedures for field documentation, and for the collection of solid and solution samples from the Heaps and from the Arimetco Plant Site.

Field Documentation

Summary of field measurement and sampling activities will be recorded in a bound site logbook, and entries must contain accurate and inclusive documentation of project activities. Field logbooks will document where, when, how, and from whom any vital project information was obtained. Logbook entries will be complete and accurate enough to permit reconstruction of field activities. At a minimum, the following information will be recorded when the applicable procedure is being conducted:

- Sample location and description
- Site sketch showing sample location and measured distances
- References to photograph locations and numbers
- Samplers' name(s)
- Date and time of sample collection
- Designation of sample as composite or grab
- Sample matrix
- Type of sampling equipment used
- Calibration of equipment described
- Onsite measurement data (e.g., PID, temperature, pH, conductivity, etc.)

- Field observations and details important to analysis or integrity of samples (e.g., heavy rains, odors, colors, etc.)
- Preliminary sample descriptions (e.g., for soils: clay loam, very wet; for groundwater: clear water with strong ammonia-like odor)
- Type(s) of preservation used
- Lot numbers of the sample containers, sample tag numbers, chain-of-custody form numbers, and chain-of-custody seal numbers
- Shipping arrangements (overnight air bill number)
- Recipient laboratory(s)

Field parameters, including distinguishing rock appearance, soil pH, and air temperature will be recorded in the field notebook prior to obtaining solids samples. Soil data, sample collection intervals, and field screening measurements will be recorded on the appropriate excavation log during the investigation. Soil data will include soil color, moisture content, consistency, and a visual estimate of Unified Soil Classification.

Sample Collection - Solids

Samples of material will be collected from each excavation by sampling from the backhoe bucket, borehole sampler, or from the hand auger or shovel. The samples will be placed in containers appropriate for each analysis. All soil samples for chemical analysis will be immediately labeled and placed into iced coolers for transport under chain-of-custody to a Nevada-certified analytical laboratory.

If groundwater is encountered during backhoe excavations, the excavation will immediately end. No groundwater samples from the excavation would be collected because of the potential for groundwater to become contaminated from the excavation activities (i.e., digging through the sub-surface exposes groundwater to soil that is being pushed or has fallen down from above the water table). Groundwater monitoring in the Arimetco Plant Site area is addressed in the Draft Final Groundwater Conditions Work Plan (Brown and Caldwell, 2002e).

Heap and soil materials collected for whole-rock and ABA analysis will be sampled by removing, with hand tools (e.g., disposable plastic trowels or shovels), the "evaporite-mineral crust" layer and excavating from a single sample location approximately 2.5 gallons of material. This material will the shaken in a 5-gallon bucket to eliminate strata variation effects, and the following splits will be obtained by hand-sorting to eliminate oversized material:

- For whole rock analysis, obtain a 2 kg (approximately 1 quart sample) in a clean re-sealable baggy.
- For Agricultural and ABA analyses, obtain a minimum of two (2) 1 kg (approximately 1 pint samples) in clean re-sealable baggies.

Geotechnical samples collected for grain-size analysis and moisture storage capacity analyses will be collected in the 5-gallon bucket used for each sample location. No attempt to screen over-sized material will be made.

Sample Collection - Solutions

Heap drain-down samples at each location will be collected prior to recording field parameters or measuring flow. High-density polyethylene (HDPE) bottles, supplied by the analytical laboratory, will be used to collect one grab sample from the locations shown on Figures 3 and 4. Prior to collecting the actual lab sample, the collection bottle will be marked with a collection sequence number. Latex gloves will be used to handle bottles and equipment throughout each sampling event. The gloves will be changed between each sample location.

Total metals (unfiltered) samples will be each collected in 500-milliliter (mL) bottles. The following is a brief summary checklist for water sampling, based on the sampling protocol outlined above:

1. Locate accessible drainage ditches or pipe discharges where access and sampling activities create minimal disturbance to the solution being sampled. Proposed sample locations with stagnant drain-down solution will not be sampled and care will be taken to avoid collecting sediment/solids in sample containers.

2. Wear a new pair of latex gloves prior to each sampling location. Place indelible identifying mark or label on the container. Fill container directly by carefully submerging a portion of the mouth of the container into the flow, with the body of the container and hand downstream of bottle mouth. Adjust the container position as needed to obtain a nearly full container (a small head-space may remain) and care will be taken to avoid collecting sediment/solids in sample containers.
3. Thoroughly rinse container, dumping out downstream of where sample will be collected. Repeat two more times.
4. Measure and record flow (if possible), pH, conductivity, water color, dissolved oxygen, and temperature.
5. Preserve all samples as appropriate, compete documentation, package and ship or transport samples.

3.4 Quality Control Procedures

Decontamination

Disposable scoops, plastic trowels, bailers, or plastic bottles will be used, or sampling equipment will be decontaminated between each sampling location. All non-disposal sampling equipment will be hand-washed with a solution of tap water and Alconox detergent, then double-rinsed. The decontamination wash would be accomplished with clean buckets, filled half to three-quarters full as follows:

- Bucket 1: Tap water with non-phosphate detergent such as Alconox
- Bucket 2: Clean tap water or de-ionized water.
- Bucket 3: Clean tap water or de-ionized water.

Equipment decontamination consists of the following general steps:

- Removal of gross (visible) contamination by brushing or scraping.
- Removal of residual contamination by scrub-washing in Bucket #1, rinsing in Bucket #2, then rinsing in Bucket #3. Change the water periodically to minimize the amount of residue carried over into the third rinse.

All washing and rinsing solutions are considered investigation-derived waste and will be placed in containers. After use, gloves and other disposable PPE should also be containerized and handled as investigation-derived waste.

Sample Identification and Preservation

Sample labels will be completed with a permanent waterproof marker and attached to each laboratory sample container before each sample is collected, unless specified otherwise. Labels will include the following information:

- Sample identification number
- Site location
- Sample date
- Sample time
- Sample preparation and preservative
- Analyses to be performed
- Sample substance type
- Person who collected sample

In accordance with the Draft Final QAPP, each sample will be tracked according to a unique sample field identification number assigned when the sample will be collected. This field identification number will consist of three parts:

- Sampling event sequence number
- Sampling location
- Collection sequence number

For example, the sample collected during the third sampling event at the fourth location sampled at the Slot Heap Leach Pad might be labeled: 003SHL004. Blanks and duplicate samples will be labeled in the same fashion, with no indication of their contents.

The following sample preservation methods will be followed for solution water samples. Add nitric acid to a pH less than 2 after sample collection. Check the pH by pouring a small amount of sample into the bottle cap and checking the pH with pH paper. Discard the liquid in the cap after checking the pH. Cool the sample to 4°C with ice immediately after sample collection.

Sample Handling and Transport

The quality control (QC) objectives for the sample-handling portion of the field activities are to verify that decontamination, packaging, and shipping are not introducing variables into the sampling chain that could render the validity of the samples questionable. If the analysis of any QC samples indicates that variables are being introduced into the sampling chain, then the samples shipped with the questionable QC sample will be evaluated for the possibility of contamination.

The following sample packaging and shipment procedures will be followed for the Heap solution samples to ensure that samples are intact when they arrive at the designated laboratory:

1. Place a custody seal over each container, and place each container in double zip-loc plastic bags and seal the plastic bags shut.
2. Place the protected containers in the appropriate ice chest.
3. If required, fill empty spaces in the ice chest with either pelaspan (styrofoam popcorn) or bubble-pack wrap to minimize movement of the samples during shipment. Contained ice will be double bagged in the same manner as samples.
4. Log each sample on the chain-of-custody and enclose the chain-of-custody form and other sample paperwork in the ice chest by placing it in a plastic bag and taping the bag to the inside of the ice chest lid.
5. Seal the ice chest shut with strapping tape and place two custody seals on the front of the cooler so that the custody seals extend from the lid to the main body of the ice chest. Place clear tape over each custody seal on the outside of the ice chest.
6. Label ice chest with "Fragile" and "This End Up" labels. Include a label on each cooler with the laboratory address and the return address.
7. Transport ice chests to the appropriate laboratory within 24 hours by hand-delivery or via express overnight delivery. Coordinate deliveries with the laboratory, ensuring that holding times are not violated.

Each chain-of-custody will contain the following information:

- Project name
- Sampler's name and signature
- Sample identification
- Date and time of sample collection
- Sample matrix
- Number and volume of sample containers
- Analyses requested
- Method of shipment

For soil or sediment samples collected for ABA or whole-rock analysis, each sample will be collected in zip-loc bags or a five-gallon bucket (Section 3.5) that will be sealed and labeled with similar QA/QC procedures described for other soil sample labeling and packaging prior to shipment to the analytical laboratory.

Duplicates and Blanks

Duplicate samples will be collected at a frequency of one per every 10 samples for each analysis. Duplicate samples will be collected by filling the containers for each analysis at the same time the original sample is collected. Duplicate samples will be collected in exactly the same manner as regular samples. For quality assurance purposes, duplicate samples will be labeled in the same fashion as regular samples, with no indication that they are QC samples. In accordance with the Draft Final QAPP, each sample from a duplicate set will have a unique sample number labeled in accordance with the identification protocol and the duplicates will be sent "blind" to the lab. For example, the duplicate sample to "003SHL004" might be labeled "003SHL005".

In general, equipment rinsate blanks will be collected when reusable, non-disposable sampling equipment (e.g., water level probe) are being used for the sampling event. Equipment rinsate blanks will be collected to evaluate field sampling and decontamination procedures by pouring laboratory-grade, certified organic-free water over the decontaminated sampling equipment. A minimum of one equipment rinsate blank for each matrix (e.g., soil, groundwater, etc.) is prepared each day when equipment is decontaminated in the field.

The rinsate blanks that are collected will be analyzed for the same analytes as normal samples. The equipment rinsate blanks will be preserved, packaged, and sealed in the manner described in the Draft Final QAPP. A separate identification sample number will be assigned to each rinsate blank, and it will be submitted blind to the laboratory.

Field blanks will be collected to evaluate whether contaminants have been introduced into the samples during the sampling procedures. For groundwater or surface water samples, field blanks will be created by pouring laboratory-grade de-ionized or certified organic-free water into a sampling container at one of the sampling points. Field blanks will be collected at a frequency of one per every 20 samples, with a minimum of one blank for less than 20 samples.

The exact same collection procedures will be used for preparation of field blanks as was used for regular sampling. The field blanks that are prepared will be analyzed for the same analytes as regular samples. The field blanks will be preserved, packaged, and sealed in the manner described in the appropriate section for the type of medium being prepared. A separate identification sample number will be assigned to each blank, and it will be submitted blind to the laboratory.

Trip blanks will be prepared to evaluate if the shipping and handling procedures are introducing contaminants into the sample stream and if cross contamination in the form of migration has occurred among the collected samples. For groundwater or surface water samples, field blanks will be created by pouring laboratory-grade de-ionized or certified organic-free water into a sampling container after the last sampling point. The sealed trip blanks are not opened in the field and are shipped to the laboratory in the same insulated chest with the regular samples collected for analyses. The trip blanks will be preserved, packaged, and sealed in the manner described in the QAPP for the type of medium being prepared. A separate identification sample number will be assigned to each trip blank and it will be submitted blind to the laboratory. Trip blanks will be collected at a frequency of one per sampling event per type of matrix, whether that event occurs over one day or several days.

3.5 Quality Assurance Procedures

Quality assurance (QA) procedures for data reporting, management, and verification will follow the specifications and standard operating procedures described in the Draft Final QAPP. The procedures in this Arimetco Heap Leach and Process Components Work Plan will adhere to QA/QC methods in the Draft Final QAPP to ensure that the quality and quantity of the analytical data obtained during the field activities are sufficient to support the DQOs. QA/QC issues include:

- Detection limit and laboratory analytical level requirements;
- Selection of appropriate levels of precision, accuracy, representiveness, completeness, and comparability for the data and any specific sample handling issues; and
- Identification of confidence levels for the collected data.

Data Management

The laboratory will provide analytical results in electronic and paper formats. In addition, the lab will provide copies of the supporting laboratory quality assurance documentation. At a minimum, data verification will include evaluation of sampling documentation and, representiveness, technical holding time, instrument calibration and tuning, field and lab blank sample analyses, QC sample results, field duplicates and the presence of any elevated detection limits.

The following will be addressed during the field and laboratory data validation process:

- Chain-of-custody forms and laboratory data sheets will be checked to verify that appropriate analyses were run and that the samples were analyzed within specified holding times;
- Review of duplicate and blank samples will be used to evaluate method precision by the laboratory.

- An overall review of the sample delivery group will be conducted to evaluate the overall quality of the data. Included will be a review for potential transcription errors, detection limit discrepancies, data omissions, and suspect or anomalous values.
- Electronic laboratory data will be checked against the hardcopy reports before being compiled in the database.
- The most recent data will be saved as an interim database spreadsheet until the data has been verified, then appended to the final database.
- Electronic data will be stored in a relational database within a secure server, which is backed up on a daily basis. Only authorized personnel with direct domain access and password will be able to access the database.

Field data will be reviewed. Anomalous or suspect values will be noted and an explanation provided.

3.6 Site Job Safety Analysis

A site-specific Job Safety Analysis (JSA) for this Work Plan is attached as Appendix G, in accordance with Atlantic Richfield Health and Safety protocol and the Brown and Caldwell Yerington Mine Site Health and Safety Plan (SHSP). The SHSP identifies, evaluates, and prescribes control measures for safety and health hazards, in addition to providing for emergency response at the Yerington Mine site. SHSP implementation and compliance will be the responsibility of Brown and Caldwell, with Atlantic Richfield taking an oversight and compliance assurance role. Any changes or updates will be the responsibility of Brian Bass with Brown and Caldwell, with review by Atlantic Richfield Safety Representative Lorri Birkenbuel. Three copies of this plan will be maintained. One copy will be located at the site, one copy will be located in Atlantic Richfield's Anaconda office, and one copy will be located in the Brown and Caldwell office. The SHSP includes:

- Safety and health risk or hazard analysis;
- Employee training records;
- Personal protective equipment (PPE);
- Medical surveillance;
- Site control measures (including dust control);
- Decontamination procedures;

- Emergency response; and
- Spill containment program.

The SHSP includes a section for site characterization and analysis that will identify specific site hazards and aid in determining appropriate control procedures. Required information for site characterization and analysis includes:

- Description of the response activity or job tasks to be performed;
- Duration of the planned employee activity;
- Site accessibility by air and roads;
- Site-specific safety and health hazards;
- Hazardous substance dispersion pathways; and
- Emergency response capabilities.

All contractors will receive applicable training, as outlined in 29CFR 1910.120(e) and as stated in the SHSP. Copies of Training Certificates for all site personnel will be attached to the SHSP. Personnel will initially review the JSA forms at a pre-entry briefing. Site-specific training will be covered at the briefing, with an initial site tour and review of site conditions and hazards. Records of pre-entry briefings will be attached to the SHSP.

Elements to be covered in site-specific briefing include: persons responsible for site-safety, site-specific safety and health hazards, use of PPE, work practices, engineering controls, major tasks, decontamination procedures and emergency response. Other required training, depending on the particular activity or level or involvement, may include MSHA 40-hour training and annual 8-hour refresher courses. Other training may include, but is not limited to, competent personnel training for excavations and confined space, first aid, and cardio-pulmonary resuscitation (CPR). Copies of the MSHA certificates for site personnel will be attached to the SHSP.

The individual JSA for the Arimetco Heap Leach work incorporates individual tasks, the potential hazards or concerns associated with each task, and the proper clothing, equipment, and work approach for each task. The following table outlines the tasks and associated potential hazards that are included in the Arimetco Heap Leach JSA:

SEQUENCE OF BASIC JOB STEPS	POTENTIAL HAZARDS
1. Prepare sample containers and dress in appropriate PPE.	• Burn or corrosion from acid spillage, if sample bottles do not have acid already in them.
2. Collect solution samples and decontamination of equipment.	• Skin irritation from dermal or eye contact • Slipping or falling into ponds, drainage ditches, or along embankments.
3. Collect solid materials samples	• Skin irritation from dermal or eye contact • Skin exposure to and/or inhalation of solution evaporator mist on or near VLT Heap Leach • Steep slopes, hard, sharp, irregular surfaces on all Heap Leaches
4. All Activities	• Slips, Trips, and Falls
5. All Activities	• Back, hand, or foot injuries during manual handling of materials.
6. All Activities	• Heat exhaustion or stroke.
7. All Activities	• Hypothermia or frostbite
8. Unsafe conditions.	• All potential hazards.

A copy of the Arimetco Heap Leach JSA is provided in Appendix G.

SECTION 4.0

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